Land- use planning as a tool for balancing the scientific and the social in biodiversity and ecosystem services mainstreaming? The case of Durban, South Africa.

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Abstract

This paper evaluates the role of land use planning, especially open space systems, in mainstreaming biodiversity and ecosystem services (BES) at the urban level. Whilst there is increasing interest in BES mainstreaming to balance environmental protection with socio-economic development, there is also concern that BES thinking deflects attention from underlying social justice questions. Through the case study of Durban, South Africa ‑ often held as an exemplar in BES mainstreaming - we argue open space systems can offer a pathway to BES mainstreaming that is both scientifically effective and socially just. Yet what makes this possible in Durban, we argue, is (a) a robust scientific evidence base deployed reflexively and sensitively; (b) a move towards explicit emphasis on providing benefits of BES to the most vulnerable people; and (c) supportive policy frameworks plus the presence of biodiversity managers able to navigate the political as well as scientific landscape.

Keywords: Durban; environmental mainstreaming; ecosystem services; open space system; urban planning.

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FULL MANUSCRIPT FOR BLIND REVIEW

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1. Introduction

This paper evaluates the role that land use, in particular open space systems, may play in balancing environmental and societal concerns when mainstreaming biodiversity and ecosystem services (BES) at a local government level. Using the case study of Durban, South Africa, we argue the spatial nature of land use planning offers a platform for reconciling environmental protection and social justice concerns in BES mainstreaming. However, we also argue the Durban experience shows that effective BES mainstreaming via land use requires reflexive use of the underpinning scientific knowledge and significant capacity at local government level.

1.1. Biodiversity and ecosystem services and developing country cities

The Millennium Ecosystem Assessment holds that human development relies greatly on services provided by nature (Millennium Ecosystem Assessment, 2005). Reliance on such ecosystem services for basic livelihood could be relatively high in less industrialised yet rapidly urbanising nations (Roberts et al., 2012). However, cities in low and middle-income country (LMIC) contexts also often face complex political, social, and economic challenges (Pierce et al., 2002; Swiderska, 2002), and tend to have less governmental and societal capacity to address environmental problems (Puppim de Oliveira, 2002). The immediate need to tackle socio-economic issues such as poverty, sanitation, drinking water, and infrastructure supply can place pressure on environmental protection or biodiversity conservation (Seto et al, 2012). Furthermore, the negative effects of climate change are likely to be felt first and most strongly in LMICs (Stern, 2007), with impacts such as extreme temperature, unseasonal drought, heavy

rainfall and flood not only damaging infrastructure, but also putting ecosystem services at risk. As such, the cities and countries which rely most on ecosystem services tend to (a) have less institutional capacity to balance development imperatives with environmental protection; (b) have higher exposure to effects of climate change; and (c) be less likely to have access to funds or technology to repair or replace damage.

It is for this reason that practitioners and researchers increasingly advocate the need to coordinate development alongside conservation of biodiversity and ecosystem services (BES) (e.g. Puppim de Oliveria et al., 2011; Seto et al., 2013). Damaged ecosystem functions, such as water circulation, climate regulation, and disease control, can negatively impact human well-being and in turn act as a barrier to socio-economic development (e.g. Millennium Ecosystem Assessment, 2005; Su et al, 2010). The value of healthy ecosystems in reducing the impacts of climate change in an urban setting is also recognised through the emergence of ecosystem-based adaptation (EbA) for climate change adaptation within an urban context. EbA - the use of BES as part of an overall adaptation strategy (IUCN, 2009) - is argued to produce multiple benefits to people such as climate adaptation, carbon sequestration, food security, livelihood and cultural value (Munang et al, 2013) and frame the climate challenge at a municipal or local scale where fine-scale recommendations can be made (Roberts et al, 2012). There is thus an emerging sense that BES conservation is vital to both continued development and reducing the effects of climate change.

The municipal government scale is particularly significant within this. Although cities only occupy 2-3% of the Earth’s surface, they are estimated to consume 75% of world resources and generate 50% of world wastes today (UNEP, n.d.). Yet cities also offer opportunity to mitigate

negative impacts and enact sustainable use of natural resources (Wilkinson et al., 2013; Revi et al, 2014). As above, it is local governments who have the precision to put national- or international-level environmental goals into action (Kern and Alber, 2008). Through processes such as provision of investment, determination of physical forms, and enactment of environmental management (Puppim de Oliveira et al, 2011), local government is vital in consolidating economic development and environmental conservation (Seto et al., 2013) and is thus a crucial site for realising the potential BES conservation benefits outlined above in practice.

1.2. Connecting BES and the urban scale: mainstreaming

Given the role ecosystems can play in development and in attaining climate adaptation in LMIC contexts, the health of BES can be considered an important foundation for urban sustainable development. Attaining this, however, necessitates integrating BES conservation into wider urban planning measures. As Wilkinson et al (2013) argue, it is impossible to uncouple a discussion of urban development from the urban environment and its ecological base. This integration is known in environmental governance as 'mainstreaming' (e.g. Sowman and Brown, 2006). Mainstreaming involves integration of conservation and sustainable use of biodiversity into cross-sectoral planning (SCBD, 2012), connecting this with economic (Cowling et al., 2008) and societal (Swiderska, 2002) development. The precise nature of mainstreaming will vary depending on context (Bass et al, 2010), but one avenue - as we explore in this paper - is land use. Land use planning provides legally entrenched norms and rules for making decisions about how land and associated natural resources are to be used (Cowling et al., 2008). As such, if new

norms and standards as to the value of BES conservation can be embedded into planning systems, it may ensure ecosystem integrity during development processes and help to balance social and economic development with environmental protection and associated climate adaptation benefits (Haines-Young, 2009).

1.3. Challenges to ecosystem services and biodiversity conservation

The effectiveness of ecosystem services as a conservation governance tool has, however, been challenged. Norgaard (2010) suggests the term may act as a 'complexity blinder,' over-simplifying the complex social, economic and political factors which contribute to environmental degradation in the first instance. Considering environmental problems and their solutions in terms of ecosystem services has been argued to reinforce or even increase existing social inequality by perpetuating thinking in terms of a market economy, where those already in more powerful positions continue to win out (Kosoy and Corbera, 2010; Matulis, 2014). More broadly, a focus on quantification and systematisation in urban environmental governance arguably engenders top-down technocratic solutions (Broto, 2015), excludes or marginalises those whose knowledges cannot be expressed in numerical terms (Spash, 2009), and/or deflects attention away from issues of social equality that mean some groups of people have less access to environmental amenity in the first place (Haase et al, 2017). The drive towards cross-sector consensus on the need for environmental protection that terms like ecosystem services work towards has been seen as depoliticising and tending towards maintaining the status quo (Aylett, 2010). In short, it is important to retain a healthy scepticism as to whether BES mainstreaming undertaken in the name of balancing environmental protection with social and economic

development really does deliver benefit to the most vulnerable members of society.

This paper considers this challenge of ensuring BES conservation delivers both environmental protection and equitable socio-economic benefit. To do so, we assess BES mainstreaming in Durban, South Africa, with particular focus on the role an open space system has played in the process. In urban biodiversity circles, Durban and the eThekwini Municipality governing it[1] is frequently cited as an exemplar of good practice from both an environmental and social standpoint. The Local Action for Biodiversity initiative, for instance, states:

Durban has made a name internationally for its early and comprehensive Local Agenda 21 activities and its long-term strategic planning. It was not surprising that this ICLEI member city co-initiated the Local Action for Biodiversity Project and published the first biodiversity report in terms of the project.
(eThekwini Municipality & ICLEI Africa Secretariat, 2007: 2).

The Secretariat of the Convention on Biological Diversity (2013: 42) adds "Durban, South Africa, is located in a global biodiversity hotspot and has been committed to sustainable development for decades." What is striking is that whilst critical social scholars may have good grounds to be suspicious of such claims given the concerns over ecosystem services framings outlined above, Durban's BES-related efforts appear to be viewed favourably - or at least not

1 eThekwini Municipality is the name of the metropolitan municipality governing Durban and the towns surrounding it. eThekwini Municipality itself uses the term 'Durban' to describe the location in which its BES activities largely take place (e.g. eThekwini Municipality, 2015), hence in this paper we use 'eThekwini Municipality' when referring to specific actions undertaken by the municipal government and 'Durban' to refer to the location of those actions.

remarked upon negatively - in critical environmental scholarship around the city (e.g. Bond and Dada, 2007; Aylett, 2011; Chu et al, 2017). The purpose of this paper is hence to evaluate how eThekwini Municipality has been able to attain this, and to assess what it may tell us about how land use can aid BES mainstreaming in a way that both ensures environmental protection and delivers tangible benefits to the most vulnerable.

2. Case Study

Durban is located in a biogeographic transition zone, between the Cape Temperate habitat to the south and the tropical Mozambique habitat to the north. These neighbouring habitats bring various species to the region, including endemic species that have adapted to the environments of the transition zone (eThekwini Municipality, 2015). Radical urbanisation in the past century has, however, caused a sharp decline in local biodiversity along with the disappearance and the degradation of natural habitats around Durban. Nonetheless, eThekwini Municipality has come to be widely regarded as an LMIC city government which has made progress with mainstreaming BES into local development. Key to attaining such mainstreaming has been the city's open space system, the Durban Metropolitan Open Space System (D'MOSS), which is viewed as an available, cost-effective and sustainable strategy to enhance local resilience (Longhurst, 2011; Roberts et al., 2012). D'MOSS is an interconnected greenspace system which includes both public- and privately-owned lands in eThekwini Municipality. Having originated in the late 1970s for preserving rare and endangered species, D'MOSS has evolved into a more comprehensive means of assessing ecosystem functioning (eThekwini Municipality, 2015; Shih, 2017). The plan was officially adopted in Durban in 1989 after more detailed ecological

evaluation, and in 2003 the D'MOSS conservation network was approved by councils to guide future planning and development of the open space system. The latest version of D'MOSS is a sector plan and a spatial layer, which identifies areas sustaining biodiversity and supplying ecosystem services. It is incorporated thoroughly into the city's planning systems - including Integrated Development Plan, Strategic Development Framework, Spatial Development Plans and municipal Town Planning Schemes - as a controlled development layer (eThekwini Municipality, 2015). It is the role of D'MOSS - and by extension land use - in enacting BES mainstreaming that is the focus of our paper.

One of the grounds on which eThekwini Municipality can claim progress on BES conservation comes through the annual State of Biodiversity Reports. These are produced by the Municipality's Environmental Planning and Climate Protection Department (EPCPD) and made publicly available along with supporting documentation and technical reports (eThekwini Municipality, 2011a). The 2014/15 report, for instance, noted 10% and 8.6% of D'MOSS are formally protected and managed respectively for BES; observed downward trends in invasive species across the majority of parks and nurseries; and indicated over half of vegetation types were meeting targets (eThekwini Municipality, 2015).

3. Methods

Two methods are utilised: (a) documentary analysis of textual and other statistical material pertaining to planning policies, plans and programmes, as well as biodiversity strategy and action plans; and (b) interviews with municipal government staff and academics with specialist in-depth

knowledge of issues in the case study.

3.1. Documentary analysis

To assess the processes through which BES mainstreaming was attained and the arguments and rationales used to support BES mainstreaming via land use planning, qualitative content analysis was undertaken on policy documentation produced by eThekwini Municipality. The core documentation analysed was the five-year Integrated Development Plan (IDP) for eThekwini Municipality, as well as the annual interim IDP review reports. As this is the umbrella document for all other plans, it provides a comprehensive overview of the policy landscape within which BES mainstreaming occurs (see also Sowman and Brown, 2006). Reports were sampled from 2003, when the first municipal IDP was produced after jurisdiction change, through to 2016. This IDP analysis was supplemented with review of other relevant Durban-specific documentation, with sampling following a 'snowball' approach of following up relevant references in policy documentation and peer-reviewed literature. Materials consulted were selected Spatial Development Framework documents; the Service Delivery and Budget Implementation Plan (2006-2016); State of Biodiversity Reports; and content related to development planning, environment and management on the eThekwini Municipality website (www.durban.gov.za). To reduce bias from sampling only Municipal reports and encompass independent/potentially critical perspectives, an additional narrative review of grey literature and peer-reviewed academic literature discussing BES in Durban was undertaken (see Mabon and Shih, forthcoming for further information on this process). This focused on the drivers and contexts for BES mainstreaming, such as budget allocation and the social dimensions of

environmental issues more generally in Durban.

Relevant statements in the documentation were identified showing: (a) the extent to which BES is considered in the Municipality's development framework; (b) the role of D'MOSS in BES mainstreaming; (c) the level of priority of BES conservation within wider civil affairs; and (d) the policy landscape within which BES is considered. Prior (2003) holds that the social context in which documents are utilised is just as important a part of analysis as the content of the document itself. Therefore, this more qualitative mode of sampling and analysis that allowed the researchers to take into account the wider contexts of the policies reported was considered appropriate, given the aim of understanding how BES mainstreaming in Durban balances environmental and social concerns.

3.2. Interviews

The documentary analysis was supplemented with five in-depth interviews with informants holding significant knowledge about biodiversity conservation, urban planning and/or socio-economic issues in Durban and South Africa. Whilst this may appear a small sample, the aim of the interviews was to help explain in more depth the experiences and challenges around mainstreaming observed in the documentary analysis. Chase (2005: 667) explains "any narrative is significant because it embodies – and gives us insight into – what is possible and intelligible within a specific social context," and the interviews in our study were similarly used to help understand the context of BES mainstreaming in Durban. Given the significant complexity of the topic, interviewees were sampled who would be able to talk at length about the subject. A small

focused sample was considered more appropriate to support the objectives of the study than a more extensive sample offering less in-depth knowledge.

Staff across all management levels from the Environmental Planning and Climate Protection Department (EPCPD) of eThekwini Municipality with professional expertise in biodiversity were interviewed for 60-90 minutes each (Respondents 1-3), plus an academic working at a South African university with knowledge of planning at the national level (Respondent 4). An academic with experience in social justice in post-apartheid South Africa (Respondent 5) was subsequently interviewed to provide a more cautious perspective on the success or otherwise of Durban's environmental planning measures. Whilst the academics' contributions are relatively easy to anonymise, the highly specialised and specific nature of information provided by Respondents 1-3 is likely to make it obvious they are employees of EPCPD, no matter how this is reported. To preserve participant anonymity, specific job titles beyond 'EPCPD' are therefore not given when reporting material from interviews, and caution has been exercised not to include content which may make respondents' true identities obvious. In any case, the EPCPD has over twenty staff (eThekwini Municipality, 2011b), so listing respondents as employees of EPCPD is in itself unlikely to make their personal identities apparent.

Interviews followed a semi-structured approach. An interview guide was developed to cover the topics of biodiversity conservation, the status and prospects of BES mainstreaming, and the socio-political status in Durban and South Africa. Within this, however, the interviewers were able to ask follow-up questions as required. The interviews were transcribed and analysed according to an adapted version of the voice-centred relational method (Doucet and Mauthner,

2008). This involves reading each transcript four times - once for the plot and evaluator responses; once for the speaker's own voice; once for the speaker's discussion of relationships; and once for links to wider themes. The value of this approach is that it provides a more rigorous reading of qualitative interview data, helping to draw themes and ideas out of the transcripts in a systematic way whilst still acknowledging the subjective and interpretative nature of qualitative research.

4. Findings and analysis

We break the findings down into three broad categories - scientific evidence; societal context; and political factors. Following principles for rigorous qualitative research (Mays and Pope, 1995) we refer to relevant documents or interview extracts where appropriate to support our points.

4.1. Scientific evidence base with spatial component

The first area we assess is the strong role for scientific knowledge in supporting BES conservation in Durban. Challenges around putting 'evidence-based planning' into practice are of course well-known (e.g. Davoudi, 2006; Li, 2013), and the importance of socio-political factors in attaining BES mainstreaming via land use are addressed in Sections 4.2 and 4.3. However, in Durban it is true that BES thinking is at base informed by environmental science knowledge, in particular D'MOSS. As outlined in Section 3.2., D'MOSS is an interconnected green space system comprising ecologically valuable areas in both private- and public-owned lands. It was

first developed in 1979 to protect important natural areas from urban development, but has evolved from these conservation-oriented roots to serve multiple functions and provide a comprehensive assessment of ecosystem functioning (Roberts et al, 2012; eThekwini Municipality, 2015; Shih, 2017).

The key role D'MOSS serves in relation to BES conservation actions is provision of evidence to allow a targeted approach to conservation. As one EPCPD respondent explained:

One of the things we do is to make sure that the open space system that we're asking to protect has good reasons to be protected [...] we use systematic conservation planning which uses computer algorithm to input biodiversity features along with opportunity and threat layers, for example floods, into a computer program [...] If we keep on saying no to development all of the time then we will tend to undermine our case, so we need to be clear on what it is that we want to protect.

(respondent 1, EPCPD, eThekwini Municipality)

In the respondent's words, emphasis is placed on creating a robust scientific evidence base for environmental protection, and taking a focused approach to protect the areas of greatest importance on the basis of this evidence. The process described refers to the mapping of D'MOSS, which is included as a conservation layer in GIS systems in eThekwini Municipality for communication with other sectors. This means land with high biodiversity significance is formally included within land use plans as space where development is subject to strict controls. From the outset, then, eThekwini Municipality and its D'MOSS system indicate that inclusion of

BES-related scientific knowledge within spatial planning frameworks can help to ensure locations of highest value are protected.

However, this underlying ‘scientific’ evidence base and the very idea of conservation are not apolitical. As an academic working in development studies explained when asked for her thoughts on the social implications of conservation:

Conservation, I mean that is something that has been very attached to, even colonial sort of and settler, almost going back to settler cultures […] it's absolutely clear that that's where conservation has been, even the early idea of the National Parks, I mean that all comes back to the colonial era […] You know, so conservation would be seen as something that is like reactionary basically.
(respondent 5, academic working in development studies)

Caution must therefore be exercised to ensure BES mainstreaming based on 'science' does not inadvertently repeat or reinforce historical injustices. This is something to which eThekwini Municipality appears to be sensitive, an interviewee (Respondent 1) stating that in the name of conservation "we can expropriate, there is a law in South Africa, but we don’t use it often because there is old political connotation to it". eThekwini Municipality's own description of D'MOSS likewise justifies science-based conservation firmly in terms of social justice, referring to the South African constitution:

The property as a whole may still be developed, albeit that certain very restrictive conditions

may be imposed on such development. It should be noted that Section 24. of the South African Constitution, specifically relating to Environment, has relevance whereby everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected [...] while promoting justifiable economic and social development.

(eThekwini Municipality, 2011c: np)

Given this historical context, the scientific evidence base of D'MOSS thus appears to be used as a *guide* for sustainable land use planning in Durban (Rouget, 2015) rather than a barrier to all forms of development. For instance, D'MOSS is now used not only for biodiversity conservation, but also to inform future decisions so as not to increase emissions via land use change (Aylett, 2011). This pragmatic move to allow some lands to be released from protection may help to move past the idea of BES thinking as being about preventing *all* development, which in turn may help to justify or build support in situations where preservation of greenspace *is* crucial to conservation or ecosystem-based adaptation.

In short, D'MOSS provides a vehicle for mainstreaming BES into wider development processes in Durban by formally including areas of high biodiversity as control zones in spatial planning frameworks. This means that wider urban planning is underpinned by scientific knowledge of biodiversity. Crucially, however, this scientific knowledge appears to be used reflexively and sensitively given the South African historical context, with D'MOSS guiding development rather than preventing it outright. We now assess the evidence-based yet pragmatic approach taken with D'MOSS in greater depth by discussing its relation to socio-economic development needs.

383 *4.2. Connection with societal context*

384

385 As above, it is well understood that planning is a social process (Crawford, 2016; Davoudi,
386 2006), whereby scientifically appropriate conservation must be balanced with what is considered
387 socially acceptable (Mabon and Shih, forthcoming). BES conservation in South Africa takes
388 place within a context of socio-political pressure. The very nature of South African cities -
389 sprawling with fragmented and segregated neighbourhoods - is itself a legacy of apartheid
390 policies (Du Plessis and Landman, 2002; Crane, 2006). Post-apartheid, migration into cities
391 (particularly from formerly excluded groups), has led to new problems of inadequate housing,
392 high unemployment rates and urban environmental deterioration (Cadman et al, 2010).
393 Expansive informal settlements are being created on the urban fringe, placing pressures on
394 fragile ecosystems (Goebel, 2007). Figure 2 illustrates the kind of landscape in Durban within
395 which many of the issues discussed in this paper are sited.

396

397 Further, approximately 40% of the population lived below the lower-bound poverty line in 2015,
398 with 13% of households in informal dwellings in 2016 (Statistics South Africa, 2017). Social
399 inequality continues to be politically important post-apartheid, so it is understandable that the
400 post-apartheid government has placed more emphasis on socio-economic issues than
401 conservation. Statistics South Africa (2017) observes that the Gini coefficient (per capita
402 income), a common measure of inequality, has decreased slightly for South Africa (from 0.72 in
403 2006 to 0.68 in 2015) but remains high in comparison to other nations. These levels of inequality
404 vary *within* South Africa, the black African population recording the highest Gini coefficients at
405 0.55 in 2011, and the white population the lowest at 0.42 in 2011 (Statistics South Africa, 2014).

From analysis of South Africa's Income and Expenditure Survey data, Seekings and Nattrass (2005) hold that inequality actually rose post-apartheid, increasing from 0.65 to 0.69 between 1995 and 2000, and that those marginalised during apartheid have continued to be so since.

This overarching and ongoing need to redress social inequality is reflected in the evolving rationale for D'MOSS. In 1979, the first open space plan in Durban was drawn by the Wildlife Society, and aimed at wildlife protection. In 1999, partly in response to the movement of Local Agenda 21 and the national government's increasing emphasis on social equality, D'MOSS was reconceptualised to encompass ecosystem services (Roberts and Diederichs, 2002). This shifted the focus from biodiversity conservation in the name of pure scientific value (Freund, 2001), towards understanding the multiple environmental, economic, and societal functions from which urban residents might benefit. This wider 'ecosystem services' framing was bolstered by an economic assessment of D'MOSS, which estimated its replacement value at R2.24 billion per annum (Roberts and Diederichs, 2002), later recalculated to R3.1 billion per annum (eThekwini Municipality, 2003; World Bank, 2016). This signified a financial and business case for BES conservation, extending beyond intrinsic or scientific value (Freund, 2001) and connected to socio-economic development imperatives. More recently, BES has been explicitly linked, through its role in ecosystem-based adaptation, to addressing issues of poverty and climate risk in Durban. What is significant about this is that increasing emphasis has been placed in discussions around BES in Durban (e.g. Roberts et al, 2012; Roberts and O'Donoghue, 2013) on issues of social justice, via job creation and poverty alleviation for the people most directly dependent on the services provided by ecosystems.

In short, whilst the underpinning basis of D'MOSS remains BES conservation, the way in which the EPCPD has framed and rationalised the open space system has shifted over time from 'conservation' towards ecosystem services and economic valuation. Most recently, this has moved further towards explicit consideration of how the gains from BES conservation can accrue to the most vulnerable members of society, thus linking to the political imperative to redress inequality outlined above. An example of this in practice is the Tree-Preneur programme, associated with the Buffelsdraai Landfill Site Community Reforestation Project, which works with the Wildlands Conservation Trust NGO to engage unemployed community members as 'Tree-Preneurs' to grow trees for use in a reforestation project (Douwes et al., 2015). The seedlings can then be exchanged for credit notes for food, basic goods and school fees (eThekwini Municipality, 2011d). The project is rationalised by the EPCPD thus:

Can we protect the environment at the same time while growing the economy? And can we conserve nature and biodiversity at the same time while increasing the number of jobs?
(respondent 2, EPCPD, eThekwini Municipality)

And a colleague explained, when pressed on awareness of conservation and climate issues around the project:

[We have] difficulty in communicating climate change messages. The means of communication differs according to the community; i.e. city level and rural areas. For example, Tree-Preneurs was slow to start up, but once a few people get it, then other people picked it up. Most locals just do it for the job than for the idea of climate change. The concept of climate change itself is quite

hard for locals to grasp, but it's starting to get through in the recent years.

(respondent 3, EPCPD, eThekwini Municipality)

Key to note are the range of rationales – economic development, general environmental protection, biodiversity conservation, jobs – which are deployed by EPCPD staff when discussing an initiative whose underlying motivation is BES conservation. This has the effect of creating multiple pathways towards support for actions undertaken in the name of BES conservation, not all of which require actors to buy into 'hard science' rationales around biodiversity or even climate change. Roberts (2010) believes framing BES in terms of not losing development gains post-Apartheid can help to gain political traction – which we assess in more depth in Section 4.3.

All of this indicates it is not only the presence of a scientifically robust open space system that aids BES mainstreaming, but also how this system is justified in relation to overarching socio-political imperatives. Fashioning multiple rationales for conservation actions in the way eThekwini Municipality has may increase the chances of support across sectors. Especially important within this is emphasis not only on climate change and biodiversity, but also messaging around the role BES health can play in daily living. Such benefits include environmental hazard reduction (Roberts et al, 2012); employment (Douwes et al, 2015); and food production, heat mitigation and runoff retention via, for instance, the Green Roof Initiative (eThekwini Municipality, 2011e). These rationales may be easier to engage with than potentially distant and opaque discussions on biodiversity or climate change, as they make clear the role that BES can play in preventing harm to humans or increasing quality of life.

475

476 *4.3. Political landscape*

477

478 We finally assess the role formal and informal political processes have played in moving towards
479 BES mainstreaming via open space in Durban. From a formal policy perspective, what is distinct
480 about eThekwini Municipality – and of significant advantage in working towards BES
481 mainstreaming - is that space is given explicit consideration and detail across all levels of the
482 planning process. A key reason for this is the presence of Integrated Development Plans (IDPs),
483 which were designed to redress inequalities post-Apartheid and which South African
484 municipalities are required to prepare by law to guide planning, budgeting, management and
485 decision-making. Whilst the effectiveness and propriety of IDPs has been debated in other
486 contexts (e.g. Binns and Nel, 2002; Harrison, 2001), they create a favourable environment for
487 BES mainstreaming due to their connection to Spatial Development Frameworks (SDFs) and
488 Spatial Development Plans (SDPs). The SDF and SDP translate IDP decisions into land use
489 policies (IDP 2005/2006) and detail development and management guidelines divided by river
490 catchments based on the concept of carrying capacity of land (IDP 2005/2006; eThekwini
491 Municipality, 2013) respectively. This means social, economic *and* environmental goals can be
492 considered at the same time, using land use planning to balance these by explicitly identifying
493 locations in which planning actions required to realise these goals will take place.

494

495 The annual review processes for IDPs and subsequent SDFs allow plans to be updated to rapidly
496 respond to emerging issues. The value of these short review cycles to BES mainstreaming is
497 evidenced by rapid proliferation and increasing frequency of environmental terminology (such as

sustainability and natural/ecosystem services in the earlier versions; and climate change and ecosystem-based adaptation in the later versions) in the IDPs. This is paralleled by a shift over time in the IDPs from emphasis on economic development with BES protection as a separate issue, towards identifying the links between BES and development.

The key point is that as a result of specific historical and contextual factors, eThekwini Municipality has from the outset a development framework favourable for translating high-level decisions on environmental issues into practical planning actions. The explicit focus on spatial matters creates good compatibility for preserving an open space system as a basis for BES conservation and ecosystem-based adaptation. However, whether these formal processes alone are enough to facilitate BES mainstreaming across sectors is open to question. Review of the Municipality's IDPs indicates varying recognition of the importance of BES integration with development across the Eight-Point Plan, which sets the priority areas for the Municipality's development. In Plan One: Sustaining Our Natural and Built Environment, horizontal mainstreaming (i.e. across sectors) can be more frequently observed since the 2005/2006 IDP through refinement of the Spatial Development Framework and open space systems, which provide an arena for inter-sectoral cooperation. For sectoral mandates, however, strategies to address BES are limited to specific programmes such as building, land use and environmental control compliance systems; and coastal, riverine and estuarine management plans. This goes part way to horizontal mainstreaming, but BES still seems linked mainly to discrete programmes rather than being a core concept running through all activities. Moreover, BES is rarely mentioned in the other seven plans, suggesting BES integration is still largely driven by the environmental planning sector.

When it comes to building momentum for BES mainstreaming across sectors, more informal political processes come into play. As an interviewee involved in implementing biodiversity-related projects explained, when asked how the EPCPD took steps towards mainstreaming in practice:

It's about going out and meeting these departments and providing them with guidance as to the sort of best practices they should be engaging in [...] We keep meeting the people again and again, try to circulate the information. A lot of progress is made once people start understanding the problem.

(respondent 2, EPCPD, eThekwini Municipality)

And in terms of making practical gains on BES conservation, an interviewed colleague noted the value of the tactical and strategic knowledge of a key figure in addition to institutionalised processes:

[NAMES PERSON] *is a different kind of leader. She's very good at identifying strategic opportunities.* [NAMES PERSON] *realized that choice and lobbied for the first few months she moved through the momentum. She doesn't follow the LAB step. I think with some people that's a big failure, but* [NAMES PERSON] *finds opportunity and just goes. Luckily when she changes direction she gets it right almost all of the time.*

(respondent 1, EPCPD, eThekwini Municipality)

This role of informal interaction between departments and sectors in building support, and of the less formalised ways through which policy directives are translated into action, has likewise been noted in academic outputs produced by EPCPD staff as 'learning by doing' (Roberts et al, 2012) and 'after hours' work (Leck and Roberts, 2015). This political nous is further reflected through the ways in which budgetary challenges around funding BES are surmounted. BES integration mostly falls under one of eThekwini Municipality's eight priority areas, titled "Develop and sustain our spatial, natural and built environment". However, this area has received only a very small share, mostly less than 2%, of the annual budget in the last decade. Alternative means to secure budget for BES-related activities have hence had to be imagined, as seen when interviewees discussed alien invasive species control and land acquisition respectively:

We receive funding from our own local government treasury, and additional funding from other national government departments. […] Also public private partnerships […] there is a mix of spending from funding, comes from government, businesses, international donors, some international works.

(respondent 2, EPCPD, eThekwini Municipality)

If, during January and February, the other departments have failed to spend all of their money, then we go to treasury, and try to use up all of the savings, or unspent money. Because in the case [it is] important for local government to spend all of the money.

(respondent 1, EPCPD, eThekwini Municipality)

This challenging financial backdrop means there is a need to secure alternative funding sources,

and to imagine affordable solutions to balance development with biodiversity conservation. For instance, eThekwini Municipality has developed environmental servitudes, whereby private land ownership is allowed for passive recreation, with the municipality only having to provide rate relief as compensation for the landowner managing the area responsibly (Boon, 2006). Another is ecological compensation, whereby off-site habitat creation or financial compensation (in both cases paid by the developer) is undertaken if land development becomes unavoidable (eThekwini Municipality, 2011c). These financial restrictions also reinforce the importance of robust arguments in favour of BES to attain broad engagement and support for measures.

BES mainstreaming thus happens in a political landscape, which encompasses not only formal policies but also 'informal' politics. The underpinning policy framework in eThekwini Municipality, which to an extent exists due to the social and historical context, creates a favourable environment for BES mainstreaming via land use. Yet it is also true that 'champions' with not only techno-scientific knowledge but also understanding of political processes and how to work within them are very important in moving mainstreaming forwards in a challenging and constantly shifting environment. This has been noted elsewhere in research into sustainable urban planning, not only for the EPCPD in eThekwini Municipality (Freund, 2001), but also for Curitiba in Brazil (Rabinovitch, 1992) and Barcelona in Spain (Depietri et al, 2016).

5. Discussion

5.1. Scholarly implications

We draw out two scholarly implications of our findings with regard to BES mainstreaming. One is the way in which 'science' is undertaken and utilised to inform BES conservation. Effective BES conservation within complex ecosystems and political contexts requires officials with significant technical and scientific knowledge. Biodiversity management within eThekwini Municipality is overseen by a highly skilled team, who regularly publish peer-reviewed scientific papers on their work and have involvement in the Intergovernmental Panel on Climate Change. In the context of wider awareness within South Africa over the colonised nature of education (Nathane and Harms Smith, 2017), this has potential to raise questions over whether already marginalised members of society have access to knowledge and decision-making spheres. What is noticeable in Durban, though, is that this scientific evidence base is applied cautiously and reflexively. Contrary to concerns elsewhere over conservation being led by international 'experts' (Broto, 2015), in Durban the expertise is locally situated, coming from within the EPCPD and University of KwaZulu-Natal and moving to encompass community actors (e.g. Taylor et al, 2016). In other contexts, such 'local experts' who are themselves citizens as well as scientists (e.g. McKechnie, 1996; Mabon and Kawabe, 2016) have been argued to be crucial in informing empirically sound yet locally appropriate decisions due to their understanding of local socio-political contexts. Further, work to provide scholarships as part of BES activities by eThekwini Municipality (e.g. Cockburn et al, 2016; Taylor et al, 2016) may help to redress differences in access to knowledge across social groups, and EPCPD staff are willing to open themselves up to frank and critical reflection on their practice in academic literature (e.g. Leck and Roberts, 2015).

Thus, whilst eThekwini Municipality does work on the basis of BES conservation based on

scientific evidence, this is undertaken by locally-situated actors who appear aware of – and are working to address – social inequalities that uncritical application of conservation and ecosystem services thinking is argued in the wider literature to have the potential to intensify. This may help to sidestep some of the concerns about ecosystem services-based thinking as perpetuating existing structural causes of inequality raised in Section 1. For BES mainstreaming, the Durban case indicates that whilst there is of course a key role for scientific evidence in developing open space systems, it is crucial this 'evidence' is tempered with recognition of the social context of knowledge production and is used to guide – rather than control – BES conservation.

Our second reflection is on the potential for land use, especially open space systems, as a means of attaining environmentally sound yet socially appropriate BES mainstreaming. EThekwini Municipality's open space system offers an example of how BES mainstreaming via spatial planning may balance up environmental and societal pressures. By mapping out greenspaces and their ecosystem services via D'MOSS, the city has a scientific evidence base to justify identification of un-developable areas. This process allows developers to be offered alternative locations for projects, thereby protecting key sites but not becoming a barrier to politically important economic development. D'MOSS and associated projects also facilitate identification of ways in which greenspace (and its conservation of ecosystem services) can be a source of value - not only the financial 'value' of ecosystem services, but also potential for creating employment within communities to manage and maintain ecosystems. Including an explicit spatial dimension in BES mainstreaming may hence initiate discussion on where the benefits of BES interventions accrue in relation to potentially vulnerable communities. This use of spatial tools such as GIS has been advocated in other contexts (e.g. Apparicio et al, 2016; Haase et al,

636 2017; Pearsall, 2017) as a starting point for understanding the spatial justice dimensions of urban
637 environmental governance. It may thus be the case in Durban too that including areas of high
638 biodiversity value within planning frameworks – and indeed using land use planning as the key
639 means to enact municipal social, economic and environmental policies – helps to guide BES
640 conservation in a way that does not further marginalise already vulnerable groups.
641
642 However, the Durban case also indicates that attaining BES mainstreaming via land use requires
643 reconceptualisation of open space in terms of ecosystem function and also its contribution to
644 social justice (e.g. Curran and Hamilton, 2012; Wolch et al, 2014) rather than purely 'parks and
645 recreation'. This returns to the above point about cognitive demands and institutional capacity. In
646 this regard, developing decision-support tools which help to extend 'green infrastructure'
647 thinking beyond environmental planners (e.g. Foster et al, 2011; Norton et al, 2015) may provide
648 an avenue to connect BES conservation with urban green planning more widely. Moreover, as
649 per Buscher and de Beer (2011), sustained engagement by planners and municipal officials with
650 critical 'outside' research (as done in Durban via e.g. Chu et al, 2017) may help ensure social
651 justice concerns are not sidelined in environmental planning. In short, an open space system can
652 – if managed correctly and with appropriate critical reflection – become a guide for sustainable
653 development which is of benefit across society yet does not compromise crucial BES functions.
654
655 *5.2. Policy and planning implications*
656
657 We finally raise implications from the Durban case study for planners and practitioners working
658 on BES mainstreaming in other contexts.

First is the importance of retaining an explicit social justice angle as part of BES policy, both to sustain political traction and also retain support of communities and civil society organisations. This entails reflection on how BES conservation may help to reduce inequalities (not only though involvement in conservation, but also through initiatives such as scholarships which reduce education gaps) and/or connecting BES conservation with social policies as part of the mainstreaming process.

Second is the importance of developing and supporting 'champions' within municipal government who are aware not only of the scientific basis for BES conservation, but also the wider municipal, national and even international policy landscape. Durban illustrates that this knowledge of how to connect BES to overarching political imperatives and to understand decision-making processes is key to attaining mainstreaming in a complex and dynamic governance landscape.

Third and final is the importance for academics, international organisations, and planners working in other contexts treating 'best practice' case studies such as Durban with caution, and avoiding using them as 'truth spots' (Peck et al, 2011) where lessons learned are uncritically exported to other contexts. Whilst eThekwini Municipality has made admirable progress on BES mainstreaming, this has happened within a specific historical, social and environmental context which has engendered certain planning frameworks (e.g. IDPs) and international attention (e.g. from the 100 Resilient Cities programme and ICLEI's Local Action for Biodiversity). This is not in any way to diminish the work of the Municipality, simply to note the importance of

682 acknowledging local contextual factors when applying ‘lessons learned’ elsewhere.

683

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Figure Legend

Figure 1: Location of the Durban and eThekwini Municipal Area (source: adapted from Google Maps, 2016)

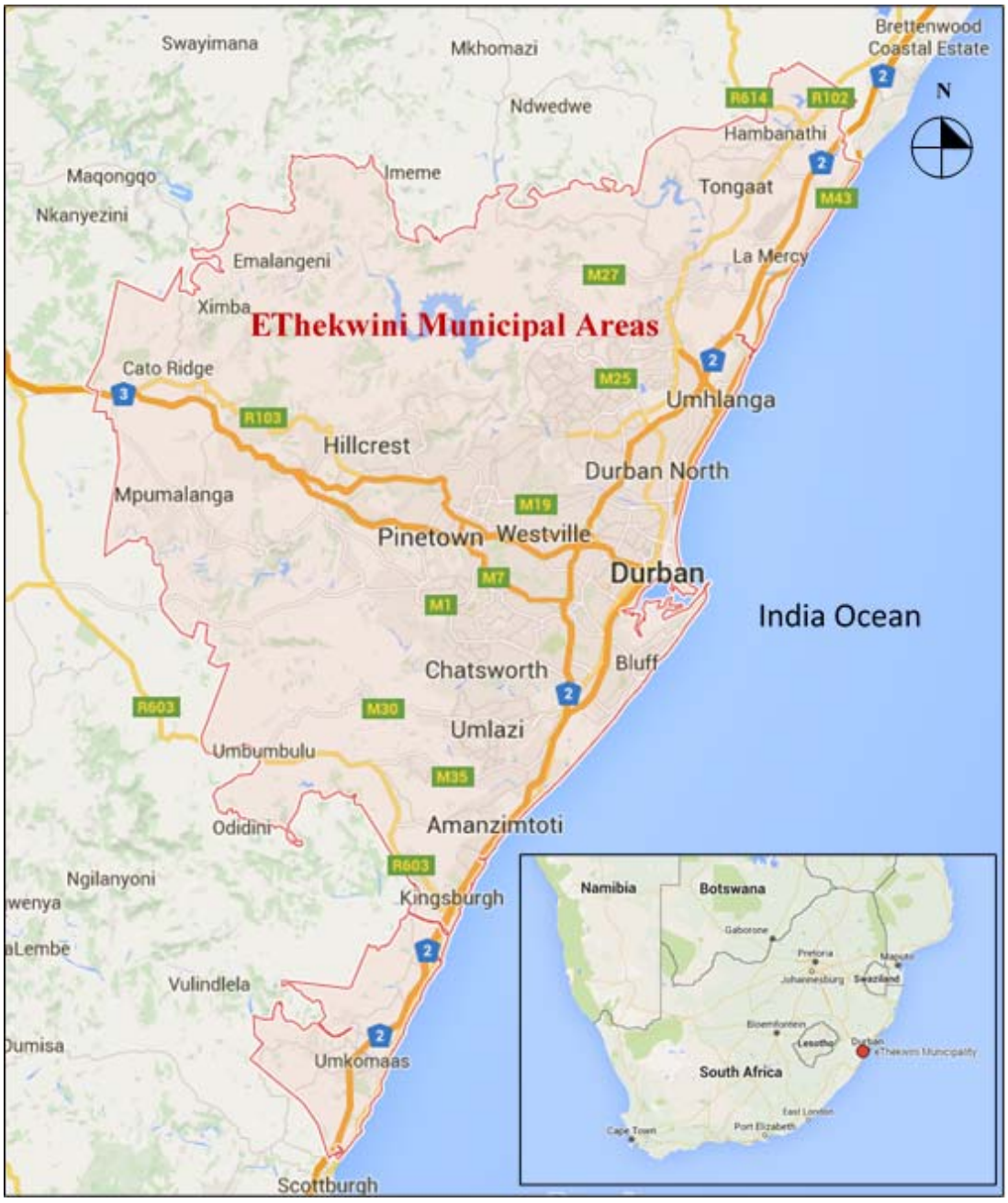

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Figure 2: Indicative image of landscape in Durban (source: taken by author)